Jeremy Potter tends the safety line for divers beneath the ice. *Credit: The Hidden Ocean, Arctic 2005 Exploration*

Ice divers Katrin Iken (left) and Shawn Harper (right) enter the water while Coast Guard Petty Officer Louis Bishop tends the line and Elizabeth Calvert stands by as the safety diver. *Credit: The Hidden Ocean, Arctic 2005 Exploration*

Mike Nicholson (left) and Joe Caba (right) move the Global Explorer ROV into position for deployment. *Credit: The Hidden Ocean, Arctic 2005 Exploration*

POLES APART: TWO POLAR MISSIONS

BY BARBARA STAHURA

The polar oceans are hostile environments that pose even more challenges to exploration and research than do warmer seas, but this hasn't deterred NOAA from investigating these regions so crucial to the Earth's climate. Not yet heavily explored, the Arctic and the Antarctic seas shelter great varieties of life, harbor numerous resources, and can tell us much about our planet's health. Two recent missions characterize NOAA's efforts to uncover more about these harsh, majestic environments, one to the north and one to the south.

The Hidden Ocean Arctic 2005

Climate change is turning the once-stable Arctic Ocean into the Earth's fastest-changing ocean area. Warmer temperatures are steadily shrinking the region's centuries-old blanket of ice and could lead to several ice-free months on the sea every year. While potentially devastating to plant and animal life adapted to year-round ice cover, this change might also mean new economic opportunities and challenges, such as management of oil exploration and fishing.

In summer 2005, NOAA funded The Hidden Ocean Arctic 2005 expedition to the Canada Basin to gather baseline data as a benchmark in this transformation, by exploring its three habitats: sea ice, water column, and sea floor. Led by Chief Scientist Rolf Gradinger, and traveling aboard the U.S. Coast Guard icebreaker USCGC *Healy*, the international team of 35 scientists took a census of marine life in one of the deepest parts of the Arctic Ocean.

Ice divers, protected against the frigid water by drysuits, descended under ice several meters thick to gather amphipods and obtain still photos and video. To ensure their safe return from beneath the constantly shifting ice, divers were tethered by a line to safety support on the sea ice surface. Other scientists worked atop the sea ice, taking core samples to examine the plants and animals living and growing in the sea ice. Temperature and salinity measurements of the ice core provide information about the environment inside the ice where organisms live, and provide scientists with information about recent air temperatures in the region. A marine mammal expert listened for seals and whales through a hydrophone dipped in the sea. Other scientists gathered specimens of life in the deep by taking core samples of the muddy seafloor, and some collected gelatinous zooplankton floating in the water.

Sophisticated equipment allowed the team to see beneath the ocean in exquisite detail and over longer periods of time than a human could tolerate. Global Explorer, a remotely-operated vehicle (ROV), glided down to 9,000 feet, capturing fragile animals and shooting stunning high-definition video footage, and a drop camera lowered to the sea bottom documented life there through the capture of thousands of still images. The *Healy*'s sophisticated echosounder systems mapped the deep sea floor, while passive sound detectors tracked whales traveling through the region.

Katrin Iken (left) and Bodil Bluhm move deep-sea mud from the trawl net to a bucket. The benthic scientists will sieve the mud to find creatures within it for additional research. *Credit: The Hidden Ocean, Arctic 2005 Exploration*

An unknown species of commensal amphipod captured below 1,000 meters with the multinet. *Credit: Russ Hopcroft, California State University, Monterey Bay*

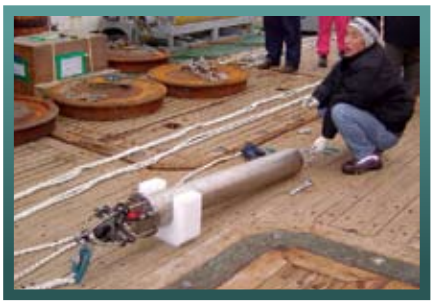
The Hidden Ocean expedition began painting a more complete picture of the Arctic food web — a valuable record in the face of the uncertainty of climate change.

The Hidden Ocean – www.oceanexplorer.noaa.gov/explorations/05arctic/welcome.html

Sounds of the Southern Ocean

Imagine what you might hear under the Southern Ocean surrounding Antarctica: The grinding of its immense, moving ice sheets against one another and against the land mass. The basso profundo rumbles of undersea volcanoes and earthquakes. The haunting voices of visiting baleen whales.

In December 2005, scientists from NOAA and the Korean Polar Research Institute traveled to this largely unexplored region for an expedition called Sounds of the Southern Sea. A Russian research vessel — and icebreaker — ferried them to the Bransfield Straits and the Drake Passage, where they deployed seven autonomous underwater hydrophones (AUH) in 400 feet of water, each one tethered to an 850-pound railroad wheel anchor. These hydrophones were specially designed to spend a year recording sounds while submerged in the often-turbulent, icy waters. In December 2006, scientists returned to retrieve the hydrophones.



Above, left: Deploying the second hydrophone off Livingston Island. Above, right: The "Haruphone" hydrophone on the deck of the *Yuzhmorgeologiya*. *Credits: NOAA/Vents, Korea Polar Research Institute (KOPRI)*

What might these sounds tell us? Given Antarctica's relative inaccessibility and severe climate, it has never been possible to study the seafloor's active volcanic regions or to understand how the movement of tectonic plates produce earthquakes or landslides in the region. With a better understanding, scientists can monitor volcanic upheavals and plate movements more effectively and perhaps predict how they might affect the Antarctic or the Earth as a whole. In addition, the Southern Ocean is a critical habitat for great whales, so learning more about how these giant, mysterious mammals live will mean better protection for them — and their presence there means a more wondrous world for us all.

Sounds of the Southern Ocean – www.oceanexplorer.noaa.gov/explorations/05sounds/welcome.html

INTERNATIONAL POLAR YEAR

The International Polar Year (IPY) is 2007-08, the fourth time the nations of the world officially turn their attention to better observation and understanding of the Earth's polar regions to gain a deeper knowledge of the importance of these regions to the major atmospheric, ocean, and terrestrial systems that control our planet. The IPY is a joint initiative of the World Meteorological Organization and the International Council for Science, with 60 countries formally involved in the research efforts.

During the last IPY in 1957-58, international cooperation led to the creation of the Antarctic Treaty, which secured Antarctica as a continent of peace and science, forever protected from the control of any nation. During this IPY, participating nations urge continued scientific collaboration and cooperation, and the sharing of the knowledge gained among all the nations of the world for the good of all.

THE OZONE HOLE

Since the mid-1980s, NOAA has played a key role in understanding the Antarctic "ozone hole," thanks to the work of atmospheric scientist Susan Solomon at the NOAA Aeronomy Lab in Boulder, Colo. Solomon conducted key experiments that identified the mechanism that produces this severe thinning in the Earth's protective ozone layer, namely, chemical reactions involving man-made chlorine. Her work helped bring about the Montreal Protocol, which banned the production of ozone-depleting chemicals, and in 1999, she was awarded the National Medal of Science, the nation's highest scientific honor, for her pioneering research.

When the ozone layer thins, more of the sun's most harmful rays pass through the atmosphere, which potentially increases skin cancers, causes damage to plants, and reduces ocean plankton. Over Antarctica, springtime weather conditions lead to significantly more thinning of the ozone layer than elsewhere in the world.